ON THE
EDUCATION OF THE JUDGMENT.

I TAKE courage, Sir,* from your presence here this day, to speak boldly that which is upon my mind. I feared that it might be unpleasant to some of my audience, but as I know that your Royal Highness is a champion for and desires the truth, I will believe that all here are united in the same cause, and therefore will give utterance, without hesitation, to what I have to say regarding the present condition of Mental Education.

If the term education may be understood in so large a sense as to include all that belongs to the improvement of the mind, either by the acquisition of the knowledge of others, or by increase of it through its own exertions, then I may hope to be justified for bringing forward a few desultory observations respecting the exercise of the mental powers in a particular direction, which otherwise might seem out of place. The points I have in view are general, but they are manifest in a striking manner, among the physical matters which have occupied my life; and as the latter afford a field for exercise in which cogitations and conclusions can be subjected to the rigid tests of fact and experiment,—as all classes employ themselves more or less in the consideration of physical matters, and may do so with great advantage, if inclined in the least degree to profit by educational practices, so

* Prince Albert occupied the chair.

I hope that what I may say will find its application in every condition of life.

Before entering upon the subject, I must make one distinction which, however it may appear to others, is to me of the utmost importance. High as man is placed above the creatures around him, there is a higher and far more exalted position within his view; and the ways are infinite in which he occupies his thoughts about the fears, or hopes, or expectations of a future life. I believe that the truth of that future cannot be brought to his knowledge by any exertion of his mental powers, however exalted they may be; that it is made known to him by other teaching than his own, and is received through simple belief of the testimony given. Let no one suppose for a moment that the self-education I am about to commend in respect of the things of this life, extends to any considerations of the hope set before us, as if man by reasoning could find out God. It would be improper here to enter upon this subject further than to claim an absolute distinction between religious and ordinary belief. I shall be reproached with the weakness of refusing to apply those mental operations which I think good in respect of high things to the very highest. I am content to bear the reproach. Yet, even in earthly matters, I believe that the invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made, even His eternal power and Godhead; and I have never seen anything incompatible between those things of man which can be known by the spirit of man which is within him, and those higher things concerning his future which he cannot know by that spirit.

Claiming, then, the use of the ordinary faculties of the

mind in ordinary things, let me next endeavour to point out what appears to me to be a great deficiency in the exercise of the mental powers in every direction: three words will express this great want, *deficiency of judgment.* I do not wish to make any startling assertion, but I know that in physical matters multitudes are ready to draw conclusions who have little or no power of judgment in the cases; that the same is true of other departments of knowledge; and that, generally, mankind is willing to leave the faculties which relate to judgment almost entirely uneducated, and their decisions at the mercy of ignorance, prepossessions, the passions, or even accident.

Do not suppose, because I stand here and speak thus, making no exceptions, that I except myself. I have learned to know that I fall infinitely short of that efficacious exercise of the judgment which may be attained. There are exceptions to my general conclusion, numerous and high; but if we desire to know how far education is required, we do not consider the few who need it not, but the many who have it not; and in respect of judgment, the number of the latter is almost infinite. I am moreover persuaded, that the clear and powerful minds which have realized in some degree the intellectual preparation I am about to refer to, will admit its importance, and indeed its necessity; and that they will not except themselves, nor think that I have made my statement too extensive.

As I believe that a very large proportion of the errors we make in judgment is a simple and direct result of our perfectly unconscious state, and think that a demonstration of the liabilities we are subject to would aid greatly in providing a remedy, I will proceed first to a few illustrations of a physical nature. Nothing can

better supply them than the intimations we derive from our senses: to them we trust directly; by them we become acquainted with external things, and gain the power of increasing and varying facts upon which we entirely depend. Our sense perceptions are wonderful. Even in the observant, but unreflective infant, they soon produce a result which looks like intuition, because of its perfection. Coming to the mind as so many data, they are stored up, and, without our being conscious of it, are ever after used in like circumstances in forming our judgment; and it is not wonderful that man is accustomed to trust them without examination. Nevertheless, the result is the effect of education: the mind has to be instructed with regard to the senses and their intimations through every step of life; and where the instruction is imperfect, it is astonishing how soon and how much their evidence fails us. Yet, in the latter years of life, we do not consider this matter, but, having obtained the ordinary teaching sufficient for ordinary purposes, we venture to judge of things which are extraordinary for the time, and almost always with the more assurance as our powers of observation are less educated. Consider the following case of a physical impression, derived from the sense of touch, which can be examined and verified at pleasure:—If the hands be brought towards each other so that the tips of the corresponding fingers touch, the end of any finger may be considered as an object to be felt by the opposed finger; thus, the two middle fingers may for the present be so viewed. If the attention be directed to them, no difficulty will be experienced in moving each lightly in a circle round the tip of the other, so that they shall each feel the opposite, and the motion may be either in one

direction or the other—looking at the fingers, or with eyes employed elsewhere—or with the remaining fingers touching quiescently, or moving in a like direction; all is easy, because each finger is employed in the ordinary or educated manner whilst obeying the will, and whilst communicating through the sentient organ with the brain. But turn the hands half way round, so that their backs shall be towards each other, and then, crossing them at the wrists, again bring the like fingers into contact at the tips. If it be now desired to move the extremities of the middle fingers round each other, or to follow the contour of one finger by the tip of the opposed one, all sorts of confusion in the motion will ensue; and as the finger of one hand tries, under the instruction of the will, to move in one course, the touched finger will convey an intimation that it is moving in another. If all the fingers move at once, all will be in confusion, the ease and simplicity of the first case having entirely disappeared. If, after some considerable trial, familiarity with the new circumstances have removed part of the uncertainty, then, crossing the hands at the opposite sides of the wrists will renew it. These contrary results are dependent not on any change in the nature of the sentient indication, or of the surfaces or substances which the sense has to deal with, but upon the trifling circumstance of a little variation from the direction in which the sentient organs of these parts are usually exerted, and they show to what an extraordinary extent our interpretations of the sense impressions depend upon the experience, *i.e.* the education which they have previously received, and their great inability to aid us at once in circumstances which are entirely new.

At other times they fail us because we cannot keep a true remembrance of former impresssions. Thus, on the evening of the eleventh of March last, I and many others were persuaded that at one period the moon had a real green colour, and though I knew that the prevailing red tints of the general sky were competent to produce an effect of such a kind, yet there was so little of that in the neighbourhood of the planet, that I was doubtful whether the green tint was not produced on the moon by some aërial medium spread before it, until, by holding up white cards in a proper position, and comparing them with our satellite, I had determined experimentally that the effect was only one of contrast. In the midst of the surrounding tints, my memory could not recall the true sentient impression which the white of the moon most surely had before made upon the eye.

At other times the failure is because one impression is overpowered by another; for as the morning star disappears when the sun is risen, though still above the horizon and shining brightly as ever, so do stronger phenomena obscure weaker, even when both are of the same kind; till an uninstructed person is apt to pass the weaker unobserved, and even deny their existence.

So, error results occasionally from believing our senses: it ought to be considered, rather, as an *error of the judgment* than of the sense, for the latter has performed its duty; the indication is always correct, and in harmony with the great truth of nature. Where, then, is the mistake?—almost entirely with our judgment. We have not had that sufficient instruction by the senses which would justify our making a conclusion; we have to contrive extra and special means, by which their first impressions shall be corrected, or rather en-

larged; and it is because our procedure was hasty, our data too few, and our judgment untaught, that we fell into mistake; not because the data were wrong. How frequently may each one of us perceive, in our neighbours, at least, that a result like this derived from the observation of physical things, happens in the ordinary affairs of common life.

When I become convicted of such haste, which is not unfrequently the case, I look back upon the error as one of "presumptuous judgment." Under that form it is easily presentable to the mind, and has a useful corrective action. I do not think the expression too strong; for if we are led, either by simplicity or vanity, to give an opinion upon matters respecting which we are not instructed, either by the knowledge of others, or our own intimate observation; if we are induced to ascribe an effect to one force, or deny its relation to another, knowing little or nothing of the laws of the forces, or the necessary conditions of the effect to be considered; surely our judgment must be qualified as "presumptuous."

There are multitudes who think themselves competent to decide, after the most cursory observation, upon the cause of this or that event (and they may be really very acute and correct in things familiar to them):—a not unusual phrase with them is, that "it stands to reason," that the effect they expect should result from the cause they assign to it, and yet it is *very difficult*, in numerous cases that appear plain, to show this reason, or to deduce the true and only rational relation of cause and effect. In matters connected with natural philosophy, we have wonderful aid in the progress and assurance in the character of our final judgment afforded us by the facts

which supply our data, and the experience which multiplies their number and varies their testimony. A fundamental fact, like an elementary principle, never fails us, its evidence is always true; but, on the other hand, we frequently have to ask what is the fact?—often fail in distinguishing it,—often fail in the very statement of it,—and mostly overpass or come short of its true recognition.

If we are subject to mistake in the interpretation of our mere sense impressions, we are much more liable to error when we proceed to deduce from these impressions (as supplied to us by our ordinary experience), the relation of cause and effect; and the accuracy of our judgment, consequently, is more endangered. Then our dependence should be upon carefully observed facts, and the laws of nature; and I shall proceed to a further illustration of the mental deficiency I speak of, by a brief reference to one of these.

The *laws of nature*, as we understand them, are the foundation of our knowledge in natural things. So much as we know of them has been developed by the successive energies of the highest intellects, exerted through many ages. After a most rigid and scrutinizing examination upon principle and trial, a definite expression has been given to them; they have become, as it were, our belief or trust. From day to day we still examine and test our expressions of them. We have no interest in their retention if erroneous; on the contrary, the greatest discovery a man could make would be to prove that one of these accepted laws was erroneous, and his greatest honour would be the discovery. Neither would there be any desire to retain the former expression; for we know that the new or the amended law

would be far more productive in results, would greatly increase our intellectual acquisitions, and would prove an abundant source of fresh delight to the mind.

These laws are numerous, and are more or less comprehensive. They are also precise; for a law may present an apparent exception, and yet not be less a law to us, when the exception is included in the expression. Thus, that elevation of temperature expands all bodies is a well-defined law, though there be an exception in water for a limited temperature; because we are careful, whilst stating the law, to state the exception and its limits. Pre-eminent among these laws, because of its simplicity, its universality, and its undeviating truth, stands that enunciated by Newton (commonly called the *law of gravitation*), that matter attracts matter with a force inversely as the square of the distance. Newton showed that, by this law, the general condition of things on the surface of the earth is governed; and the globe itself, with all upon it, kept together as a whole. He demonstrated that the motions of the planets round the sun, and of the satellites about the planets, were subject to it. During and since his time, certain variations in the movements of the planets, which were called irregularities, and might, for aught that was then known, be due to some cause other than the attraction of gravitation, were found to be its necessary consequences. By the close and scrutinizing attention of minds the most persevering and careful, it was ascertained that even the distant stars were subject to this law; and, at last, to place as it were the seal of assurance to its never-failing truth, it became, in the minds of Leverrier and Addams (1845), the foreteller and the discoverer of an orb rolling in the depths of space, so large as to equal nearly sixty

earths, yet so far away as to be invisible to the unassisted eye. What truth, beneath that of revelation, can have an assurance stronger than this!

Yet this law is often cast aside as of no value or authority, because of the unconscious ignorance amidst which we dwell. You hear at the present day, that some persons can place their fingers on a table, and then elevating their hands, the table will rise up and follow them; that the piece of furniture, though heavy, will ascend, and that their hands bear no weight, or are not drawn down to the wood: you do not hear of this as a conjuring manœuvre, to be shown for your amusement, but are expected seriously to believe it; and are told that it is an important fact, a great discovery amongst the truths of nature. Your neighbour, a well-meaning, conscientious person, believes it; and the assertion finds acceptance in every rank of society, and amongst classes which are esteemed to be educated. Now, what can this imply but that society, speaking generally, is not only ignorant as respects education of the judgment, but is also ignorant of its ignorance? The parties who are thus persuaded, and those who are inclined to think and to hope that they are right, throw up Newton's law at once, and *that* in a case which of all others is fitted to be tested by it; or if the law be erroneous, to test the law. I will not say they oppose the law, though I *have* heard the supposed fact quoted triumphantly against it; but as far as my observation has gone, they will not apply it. The law affords the simplest means of testing the fact; and if there be, indeed, anything in the latter new to our knowledge (and who shall say that new matter is not presented to us daily, passing away unrecognised), it also affords the

means of placing *that* before us separately in its simplicity and truth. Then why not consent to apply the knowledge we have to that which is under development? Shall we educate ourselves in what is known, and then, casting away all we have acquired, turn to our ignorance for aid to guide us among the unknown? If so, instruct a man to write, but employ one who is unacquainted with letters to read that which is written; the end will be just as unsatisfactory, though not so injurious, for the book of nature, which we have to read, is written by the finger of God. Why should not one who can thus lift a table, proceed to verify and simplify his fact, and bring it into relation with the law of Newton? Why should he not take the top of his table (it may be a small one), and placing it in a balance, or on a lever, proceed to ascertain how much weight he can raise by the draught of his fingers upwards; and of this weight, so ascertained, how much is unrepresented by any pull upon the fingers downward? He will then be able to investigate the further question, whether electricity, or any new force of matter, is made manifest in his operations; or whether action and reaction being unequal, he has at his command the source of a perpetual motion. Such a man, furnished with a nicely constructed carriage on a railway, ought to travel by the mere draught of his own fingers. A far less prize than this would gain him the attention of the whole scientific and commercial world; and he may rest assured, that if he can make the most delicate balance incline or decline by attraction, though it be only with the force of an ounce, or even a grain, he will not fail to gain universal respect and most honourable reward.

When we think of the laws of nature (which by con-

tinued observation have become known to us), as the proper tests to which any new fact, or our theoretical representation of it, should, in the first place, be subjected, let us contemplate their assured and large character. Let us go out into the field and look at the heavens, with their solar, starry, and planetary glories; the sky with its clouds; the waters descending from above, or wandering at our feet; the animals, the trees, the plants; and consider the permanency of their actions and conditions under the government of these laws. The most delicate flower, the tenderest insect, continues in its species through countless years; always varying, yet ever the same. When we think we have discovered a departure, as in the *Aphides*, *Medusæ*, *Distomæ*, &c., the law concerned is itself the best means of instituting an investigation, and hitherto we have always found the witness to return to its original testimony. These frail things are never ceasing, never changing, evidence of the law's immutability. It would be well for a man who has an anomalous case before him, to contemplate a blade of grass, and when he has considered the numerous ceaseless, yet certain, actions there located, and his inability to change the character of the least among them, to recur to his new subject; and, in place of accepting unwatched and unchecked results, to search for a like certainty and recurrence in the appearances and actions which belong to it.

Perhaps it may be said, the delusion of table-moving is past, and need not be recalled before an audience like the present;—even granting this, let us endeavour to make the subject leave one useful result; let it serve for an example, not to pass into forgetfulness. It is so recent, and was received by the public in a manner so

strange, as to justify a reference to it, in proof of the uneducated condition of the general mind. I do not object to table-moving, for *itself;* for being once stated it becomes a fit, though a very unpromising subject for experiment: but I am opposed to the unwillingness of its advocates to investigate; their boldness to assert; the credulity of the lookers-on; their desire that the reserved and cautious objector should be in error; and I wish, by calling attention to these things, to make the general want of mental discipline and education manifest.

Having endeavoured to point out this great deficiency in the exercise of the intellect, I will offer a few remarks upon the means of subjecting it to the improving processes of instruction. Perhaps many who watch over the interests of the community, and are anxious for its welfare, will conclude, that the development of the judgment cannot properly be included in the general idea of education; that as the education proposed must, to a very large degree, be of *self*, it is so far incommunicable; that the master and the scholar merge into one, and both disappear; that the instructor is no wiser than the one to be instructed, and thus the usual relations of the two lose their power. Still, I believe that the judgment may be educated to a very large extent, and might refer to the fine arts, as giving proof in the affirmative; and though, as respects the community and its improvement in relation to common things, any useful education must be of *self*, I think that society, as a body, may act powerfully in the cause. Or it may still be objected that my experience is imperfect, is chiefly derived from exercise of the mind within the precincts of natural philosophy, and has not that generality of application

which can make it of any value to society at large. I can only repeat my conviction, that society occupies itself now-a-days about physical matters, and judges them as common things. Failing in relation to them, it is equally liable to carry such failures into other matters of life. The proof of deficient judgment in one department shows the habit of mind, and the general want, in relation to others. I am persuaded that all persons may find in natural things an admirable school for self-instruction, and a field for the necessary mental exercise; that they may easily apply their habits of thought, thus formed, to a social use; and that they ought to do this, as a duty to themselves and their generation.

Let me first try to illustrate the former part of the case, and at the same time state what I think a man may and ought to do for himself.

The *self-education* to which he should be stimulated by the desire to improve his judgment, requires no blind dependance upon the dogmas of others, but is commended to him by the suggestions and dictates of his own common sense. The first part of it is founded in mental discipline: happily, it requires no unpleasant avowals; appearances are preserved, and vanity remains unhurt; but it is necessary that a man *examine himself*, and *that* not carelessly. On the contrary, as he advances, he should become more and more strict, till he ultimately prove a sharper critic to himself than any one else can be; and he ought to intend this, for, so far as he consciously falls short of it, he acknowledges that others may have reason on their side when they criticise him. A first result of this habit of mind will be an internal conviction of *ignorance in many things respecting which*

his neighbours are taught, and that his opinions and conclusions on such matters ought to be advanced with reservation. A mind so disciplined will be *open to correction, upon good grounds, in all things*, even in those it is best acquainted with; and should familiarize itself with the idea of such being the case: for though it sees no reason to suppose itself in error, yet the possibility exists. The mind is not enfeebled by this internal admission, but strengthened; for, if it cannot distinguish proportionately between the probable right and wrong of things known imperfectly, it will tend either to be rash or to hesitate; whilst that which admits the due amount of probability is likely to be justified in the end. It is right that we should stand by and act on our principles; but not right to hold them in obstinate blindness, or retain them when proved to be erroneous. I remember the time when I believed a spark was produced between voltaic metals as they approached to contact (and the reasons why it might be possible yet remain); but others doubted the fact and denied the proofs, and on re-examination I found reason to admit their corrections were well founded. Years ago I believed that electrolytes could conduct electricity by a conduction proper; that has also been denied by many through long time: though I believed myself right, yet circumstances have induced me to pay such respect to criticism as to reinvestigate the subject, and I have the pleasure of thinking that nature confirms my original conclusions. So, though evidence may appear to preponderate extremely in favour of a certain decision, it is wise and proper to hear a counter-statement. You can have no idea how often and how much, under such an impression, I have desired that the marvellous descrip-

tions which have reached me might prove, in some points, correct; and how frequently I have submitted myself to hot fires, to friction with magnets, to the passes of hands, &c. lest I should be shutting out discovery; encouraging the strong desire that something might be true, and that I might aid in the development of a new force of nature.

Among those points of self-education which take up the form of *mental discipline*, there is one of great importance, and, moreover, difficult to deal with, because it involves an internal conflict, and equally touches our vanity and our ease. It consists in the *tendency to deceive ourselves* regarding all we wish for, and the necessity of *resistance to these desires*. It is impossible for any one who has not been constrained, by the course of his occupation and thoughts, to a habit of continual self-correction, to be aware of the amount of error in relation to judgment arising from this tendency. The force of the temptation which urges us to seek for such evidence and appearances as are in favour of our desires, and to disregard those which oppose them, is wonderfully great. In this respect we are all, more or less, active promoters of error. In place of practising wholesome self-abnegation, we ever make the wish the father to the thought: we receive as friendly that which agrees with, we resist with dislike that which opposes us; whereas the very reverse is required by every dictate of common sense. Let me illustrate my meaning by a case where the proof being easy, the rejection of it under the temptation is the more striking. In old times, a ring or button mould be tied by a boy to one end of a long piece of thread, which he would then hold at the other end, letting the button hang within a glass, or over a

piece of slate-pencil, or sealing-wax, or a nail; he would wait and observe whether the button swung, and whether in swinging it tapped the glass as many times as the clock struck last, or moved along or across the slate-pencil, or in a circle or oval. In late times, parties in all ranks of life have renewed and repeated the boy's experiment. They have sought to ascertain a very simple fact—namely, whether the effect was as reported; but how many were unable to do this? They were sure they could keep their hands immoveable,—were sure they could do so whilst watching the result,—were sure that accordance of swing with an expected direction was not the result of their desires or involuntary motions. How easily all these points could be put to the proof by *not looking at the objects*, yet how difficult for the experimenter to deny himself that privilege. I have rarely found one who would freely permit the substance experimented with to be screened from his sight, and then its position changed.

When engaged in the investigation of table-turning, I constructed a very simple apparatus, serving as an index, to show the unconscious motions of the hands upon the table. The results were either that the index moved before the table, or that neither index nor table moved; and in numerous cases all moving power was annihilated. A universal objection was made to it by the table-turners. It was said to paralyze the powers of the mind; but the experimenters need not see the index; they may leave their friends to watch that, and their minds may revel in any power that their expectation or their imagination can confer. So restrained, a *dislike* to the trial arises; but what is that, except a proof that whilst they trust themselves they doubt

themselves, and are not willing to proceed to the decision, lest the trust which they like should fail them, and the doubt which they dislike rise to the authority of truth?

Again, in respect of the action of magnets on the body, it is almost imposible for an uninstructed person to enter profitably upon such an inquiry. He may observe *any* symptom which his expectation has been accidentally directed to; yet be unconscious of any, if unaware of his subjection to the magnetic force, or of the conditions and manner of its application.

As a proof of the extent of this influence, even on the minds of those well aware of its force, and desirous under every circumstance to escape from it, I will mention the practice of the chemist, who, dealing with the balance, that impartial decider which never fails in its indication, but offers its evidence with all simplicity, durability, and truth, still remembers he should doubt himself; and, with the desire of rendering himself inaccessible to temptation, takes a counterpoised but unknown quantity of the substance for analysis, that he may remain ignorant of the proportions which he ought to obtain, and only at last compares the sum of his products with his counterpoise.

The *inclination* we exhibit in respect of any report or opinion that harmonises with our preconceived notions, can only be compared in degree with the *incredulity* we entertain towards everything that opposes them; and these opposite and apparently incompatible, or at least inconsistent, conditions are accepted simultaneously in the most extraordinary manner. At one moment a departure from the laws of nature is admitted without the pretence of a careful examination of the proof; and

at the next, the whole force of these laws, acting undeviatingly through all time, is denied, because the testimony they give is disliked.

It is my firm persuasion, that no man can examine himself in the most common things, having any reference to him personally, or to any person, thought, or matter related to him, without being soon made aware of *the temptation* and the difficulty of opposing it. I could give you many illustrations personal to myself, about atmospheric magnetism, lines of force, attraction, repulsion, unity of power, nature of matter, &c.; or in things more general to our common nature, about likes and dislikes, wishes, hopes, and fears; but it would be unsuitable, and also unnecessary, for each must be conscious of a large field sadly uncultivated in this respect. *I will simply express my strong belief, that that point of self-education which consists in teaching the mind to resist its desires and inclinations, until they are proved to be right, is the most important of all, not only in things of natural philosophy, but in every department of daily life.*

There are numerous precepts, resulting more or less from the principles of mental discipline already insisted on as essential, which are very useful in forming a judgment about matters of fact, whether among natural things or between man and man. Such a precept, and one that should recur to the mind early in every new case is, to *know the conditions* of the matter, respecting which we are called upon to make a judgment. To suppose that any would judge before they professed to know the conditions, would seem to be absurd; on the other hand, to assume that the community *does wait* to know the conditions before it judges, is an assumption

so large that I cannot accept it. Very few search out the conditions; most are anxious to sink those which oppose their preconceptions; yet none can be left out if a right judgment is to be formed. It is true that many conditions must ever remain unknown to us, even in regard to the simplest things in nature: thus, as to the wonderful action of gravity, whose law never fails us, we cannot say whether the bodies are acting truly at a distance, or by a physical line of force as a connecting link between them. The great majority think the former is the case; Newton's judgment is for the latter. But of the conditions which are within our reach we should search out all; for in relation to those which remain unknown or unsuspected, we are in that very ignorance (regarding judgment) which it is our present object, first to make manifest, and then to remove.

One exercise of the mind, which largely influences the power and character of the judgment, is the habit of forming *clear and precise ideas*. If, after considering a subject in our ordinary manner, we return upon it with the special purpose of noticing the condition of our thoughts, we shall be astonished to find how little precise they remain. On recalling the phenomena relating to a matter of fact, the circumstances modifying them, the kind and amount of action presented, the real or probable result, we shall find that the first impressions are scarcely fit for the foundation of a judgment, and that the second thoughts will be best. For the acquirement of a good condition of mind in this respect, the thoughts should be trained to a habit of clear and precise formation, so that vivid and distinct impressions of the matter in hand, its circumstances and consequences, may remain.

Before we proceed to consider any question involving physical principles, we should set out with *clear ideas* of the naturally possible and impossible. There are many subjects uniting more or less of the most sure and valuable investigations of science with the most imaginary and unprofitable speculation, that are continually passing through their various phases of intellectual, experimental, or commercial development: some to be established, some to disappear, and some to recur again and again, like ill weeds that cannot be extirpated, yet can be cultivated to no result as wholesome food for the mind. Such, for instance, in different degrees, are the caloric engine, the electric light, the Pasilalinic sympathetic compass,* mesmerism, homœopathy, odylism, the magneto-electric engine, the perpetual motion, &c. All hear and talk of these things; all use their judgment more or less upon them, and all might do that effectively, if they were to instruct themselves to the extent which is within their reach. I am persuaded that natural things offer an admirable school for self-instruction, a most varied field for the necessary mental practice, and that those who exercise themselves therein may easily apply the habits of thought thus formed to a social use. As a first step in such practice, clear ideas should be obtained of what is possible and what is impossible. Thus, it is impossible to *create* force. We may employ it; we may evoke it in one form by its consumption in another; we may hide it for a period; but we can neither *create* nor *destroy* it. We may cast it away; but where we dismiss it, there it will do its work. If, therefore, we desire to consider a proposition respecting the employment or evolution of power, let us carry our judgment,

* See "Chambers's Journal," 1851, Feb. 15, p. 105.

educated on this point, with us. If the proposal include the double use of a force with only one excitement, it implies a creation of power, and that *cannot be.* If we could by the fingers draw a heavy piece of wood or stone upward without effort, and then, letting it sink, could produce by its gravity an effort equal to its weight, that would be a creation of power, and *cannot be.*

So again we cannot *annihilate* matter, nor can we *create* it. But if we are satisfied to rest upon that dogma, what are we to think of table-lifting? If we could make the table to cease from acting by gravity upon the earth beneath it, or by reaction upon the hand supposed to draw it upwards, we *should annihilate it,* in respect of that very property which characterises it as matter.

Considerations of this nature are very important aids to the judgment; and when a statement is made claiming our assent, we should endeavour to reduce it to some consequence which can be immediately compared with, and tried by, these or like compact and never failing truths. If incompatibility appears, then we have reason to suspend our conclusion, however attractive to the imagination the proposition may be, and pursue the inquiry further, until accordance is obtained; it must be a most uneducated and presumptuous mind that can at once consent to cast off the tried truth and accept in its place the mere loud assertion. We should endeavour to separate the points before us, and concentrate each, so as to evolve a clear type idea of the ruling fact and its consequences; looking at the matter on every side, with the great purpose of distinguishing the constituent reality, and recognising it under every variety of aspect.

In like manner we should accustom ourselves to clear and definite language, especially in physical matters

giving to a word its true and full, but measured meaning, that we may be able to convey our ideas clearly to the minds of others. Two persons cannot mutually impart their knowledge, or compare and rectify their conclusions, unless both attend to the true intent and force of language. If by such words as attraction, electricity, polarity, or atom, they imply different things, they may discuss facts, deny results, and doubt consequences for an indefinite time without any advantageous progress. I hold it as a great point in self-education, that the student should be continually engaged in forming exact ideas, and in expressing them clearly by language. Such practice insensibly opposes any tendency to exaggeration or mistake, and increases the sense and love of truth in every part of life.

I should be sorry, however, if what I have said were understood as meaning that education for the improvement and strengthening of the judgment is to be altogether repressive of the imagination, or confine the exercise of the mind to processes of a mathematical or mechanical character. I believe that, in the pursuit of physical science, the imagination should be taught to present the subject investigated in all possible, and even in impossible views; to search for analogies of likeness and (if I may say so) of opposition—inverse or contrasted analogies; to present the fundamental idea in every form, proportion, and condition; to clothe it with suppositions and probabilities, that all cases may pass in review, and be touched, if needful, by the Ithuriel spear of experiment. But all this must be *under government*, and the result must not be given to society until the judgment, educated by the process itself, has been exercised upon it. Let us construct our hypotheses for an hour, or a

day, or for years; they are of the utmost value in the elimination of truth, "which is evolved more freely from error than from confusion;" but, above all things, let us not cease to be aware of the temptation they offer, or, because they gradually become familiar to us, accept them as established. We could not reason about electricity without thinking of it as a fluid, or a vibration, or some other existent state or form. We should give up half our advantage in the consideration of heat if we refused to consider it as a principle, or a state of motion. We could scarcely touch such subjects by experiment, and we should make no progress in their practical application, without hypothesis; still it is absolutely necessary that we should learn to doubt the conditions we assume, and acknowledge we are uncertain, whether heat and electricity are vibrations or substances, or either.

When the different data required are in our possession, and we have succeeded in forming a clear idea of each, the mind should be instructed to *balance them* one against another, and not suffered carelessly to hasten to a conclusion. This reserve is most essential; and it is especially needful that the reasons which are adverse to our expectations or our desires should be carefully attended to. We often receive truth from unpleasant sources; we often have reason to accept unpalatable truths. We are never freely willing to admit information having this unpleasant character, and it requires much self-control in this respect, to preserve us, even in a moderate degree, from errors. I suppose there is scarcely one investigator in original research who has not felt the temptation to disregard the reasons and results which are against his views. I acknowledge that I have experienced it very often, and will not pretend

to say that I have yet learned on all occasions to avoid the error. When a bar of bismuth or phosphorus is placed between the poles of a powerful magnet, it is drawn into a position across the line joining the poles; when only one pole is near the bar, the latter recedes; this and the former effect is due to repulsion, and is strikingly in contrast with the attraction shown by iron. To account for it, I at one time suggested the idea that a polarity was induced in the phosphorus or bismuth the reverse of the polarity induced in iron, and that opinion is still sustained by eminent philosophers. But observe a necessary result of such a supposition, which appears to follow when the phenomena are referred to elementary principles. *Time* is shown, by every result bearing on the subject, to be concerned in the coming on and passing away of the inductive condition produced by magnetic force; and the consequence, as Thomson pointed out, is, that if a ball of bismuth could be suspended between the poles of a magnet, so as to encounter no resistance from the surrounding medium, or from friction or torsion, and were once put in motion round a vertical axis, it would, because of the assumed polar state, go on for ever revolving, the parts which at any moment are axial moving like the bar, so as to become the next moment equatorial. Now, as we believe the mechanical forces of nature tend to bring things into a stable, and not into an unstable condition; as we believe that a perpetual motion is impossible; so, because both these points are involved in the notion of the reverse polarity, which itself is not supposed to be dependent on any consumption of power, I feel bound to hold the judgment balanced, and therefore hesitate to accept a conclusion founded on such a notion of the

physical action; the more especially as the peculiar test facts* which prove the polarity of iron are not reproduced in the case of diamagnetic bodies.

As a result of this wholesome mental condition, we should be able to form a *proportionate judgment.* The mind naturally desires to settle upon one thing or another; to rest upon an affirmative or a negative; and that with a degree of absolutism which is irrational and improper. In drawing a conclusion, it is very difficult, but not the less necessary, to make it *proportionate* to the evidence: except where certainty exists (a case of rare occurrence), we should consider our decisions as probable only. The probability may appear very great, so that in affairs of the world we often accept such as certainty, and trust our welfare or our lives upon it. Still, only an uneducated mind will confound probability with certainty, especially when it encounters a contrary conclusion drawn by another from like data. This suspension in degree of judgment will not make a man less active in life, or his conclusions less certain as truths; on the contrary, I believe him to be the more ready for the right amount and direction of action on any emergency; and am sure his conclusions and statements will carry more weight in the world than those of the incautious man.

When I was young, I received from one well able to aid a learner in his endeavours towards self-improvement, a curious lesson in the mode of estimating the amount of belief one might be induced to attach to our conclusions. The person was Dr. Wollaston, who, upon a given point, was induced to offer me a wager of two to one on the affirmative. I rather impertinently quoted

* Experimental Researches in Electricity, paragraphs 2,657—2,681.

Butler's well-known lines* about the kind of persons who use wagers for argument, and he gently explained to me, that he considered such a wager not as a thoughtless thing, but as an expression of the amount of belief in the mind of the person offering it; combining this curious application of the wager, as a *meter*, with the necessity that ever existed of drawing conclusions, not absolute, but proportionate to the evidence.

Occasionally and frequently the exercise of the judgment ought to end in *absolute reservation.* It may be very distasteful, and great fatigue, to suspend a conclusion; but as we are not infallible, so we ought to be cautious: we shall eventually find our advantage, for the man who rests in his position is not so far from right as he who, proceeding in a wrong direction, is ever increasing his distance. In the year 1824, Arago discovered that copper and other bodies placed in the vicinity of a magnet, and having no direct action of attraction or repulsion upon it, did affect it when moved, and were affected by it. A copper plate revolving near a magnet carried the magnet with it; or if the magnet revolved, and not the copper, it carried the copper with it. A magnetic needle vibrating freely over a disc of glass or wood, was exceedingly retarded in its motion when these were replaced by a disc of copper. Arago stated most clearly all the conditions, and resolved the forces into three directions, but not perceiving the physical cause of the action, exercised a most wise and instructive reservation as to his conclusion. Others, as Haldat, considered it as the proof of the universality of a magnetism of the ordinary kind, and held to that

* "Quoth she, 'I've heard old cunning stagers,
Say fools for arguments use wagers.'"

notion though it was contradicted by the further facts; and it was only at a future period that the true physical cause, namely, magneto-electric currents induced in the copper, became known to us. What an education Arago's mind must have received in relation to philosophical reservation; what an antithesis he forms with the mass of table-turners; and what a fine example he has left us of that condition of judgment to which we should strive to attain!

If I may give another illustration of the needful reservation of judgment, I will quote the case of oxygen and hydrogen gases, which, being mixed, will remain together uncombined for years in contact with glass, but in contact with spongy platinum combine at once. We have the same fact in many forms, and many suggestions have been made as to the mode of action, but as yet we do not know *clearly* how the result comes to pass. We cannot tell whether electricity acts or not. Then we should suspend our conclusions. Our knowledge of the fact itself, and the many varieties of it, is not the less abundant or sure; and when the truth shall hereafter emerge from the mist, we ought to have no opposing prejudice, but be prepared to receive it.

The education which I advocate will require *patience* and *labour of thought* in every exercise tending to improve the judgment. It matters not on what subject a person's mind is occupied, he should engage in it with the conviction that it will require mental labour. A powerful mind will be able to draw a conclusion more readily and more correctly than one of moderate character, but both will surpass themselves if they make an earnest, careful investigation, instead of a careless or prejudiced one; and education for this purpose is the

more necessary for the latter, because the man of less ability may, through it, raise his rank and amend his position. I earnestly urge this point of self-education, for I believe it to be more or less in the power of every man greatly to improve his judgment. I do not think that one has the complete capacity for judgment which another is naturally without. I am of opinion that all may judge, and that we only need to declare on every side the conviction that mental education is wanting, and lead men to see that through it they hold, in a large degree, their welfare and their character in their own hands, to cause in future years an abundant development of right judgment in every class.

This education has for its first and its last step *humility*. It can commence only because of a conviction of deficiency; and if we are not disheartened under the growing revelations which it will make, that conviction will become stronger unto the end. But the humility will be founded, not on comparison of ourselves with the imperfect standards around us, but on the increase of that internal knowledge which alone can make us aware of our internal wants. The first step in correction is to learn our deficiencies, and having learned them, the next step is almost complete: for no man who has discovered that his judgment is hasty, or illogical, or imperfect, would go on with the same degree of haste, or irrationality, or presumption as before. I do not mean that all would at once be cured of bad mental habits, but I think better of human nature than to believe, that a man, in any rank of life, who has arrived at the consciousness of such a condition, would deny his common sense, and still judge and act as before. And though such self-schooling must continue to the end of life to supply an

experience of deficiency rather than of attainment, still there is abundant stimulus to excite any man to perseverance. What he has lost are things imaginary, not real; what he gains are riches before unknown to him, yet invaluable; and though he may think more humbly of his own character, he will find himself at every step of his progress more sought for than before, more trusted with responsibility and held in pre-eminence by his equals, and more highly valued by those whom he himself will esteem worthy of approbation.

And now a few words upon the mutual relation of two classes, namely, *those* who decline to educate their judgments in regard to the matters on which they decide, and those who, by self-education, have endeavoured to improve themselves; and upon the remarkable and somewhat unreasonable manner in which the latter are called upon, and occasionally taunted, by the former. A man who makes assertions, or draws conclusions, regarding any given case, ought to be competent to investigate it. He has no right to throw the onus on others, declaring it their duty to prove him right or wrong. His duty is to demonstrate the truth of that which he asserts, or to cease from asserting. The men he calls upon to consider and judge have enough to do with themselves, in the examination, correction, or verification of their own views. The world little knows how many of the thoughts and theories which have passed through the mind of a scientific investigator have been crushed in silence and secrecy by his own severe criticism and adverse examination; that in the most successful instances not a tenth of the suggestions, the hopes, the wishes, the preliminary conclusions have been realized. And is a man so occupied to be taken from his search after truth

in the path he hopes may lead to its attainment, and occupied in vain upon nothing but a broad assertion?

Neither has the assertor of any new thing a right to claim an answer in the form of *Yes* or *No;* or think, because none is forthcoming, that he is to be considered as having established his assertion. So much is unknown to the wisest man, that he may often be without an answer; as frequently he is so, because the subject is in the region of hypothesis, and not of facts. In either case he has the right to refuse to speak. I cannot tell whether there are two fluids of electricity or any fluid at all. I am not bound to explain how a table tilts any more than to indicate how, under the conjuror's hands, a pudding appears in a hat. The means are not known to me. I am persuaded that the results, however strange they may appear, are in accordance with that which is truly known, and if carefully investigated would justify the well-tried laws of nature; but, as life is limited, I am not disposed to occupy the time it is made of in the investigation of matters which, in what is known to me of them, offer no reasonable prospect of any useful progress, or anything but negative results. We deny the right of those who call upon us to answer their speculations "*if we can*," whilst we have so many of our own to develop and correct; and claim the right for ourselves of withholding either our conclusions or the reasons for them, without in the least degree admitting that their affirmations are unanswerable. We are not even called upon to give an answer to the best of our belief: nor bound to admit a bold assertion because we do not *know* to the contrary. No one is justified in claiming our assent to the spontaneous generation of insects, because we cannot circumstantially explain how

a mite or the egg of a mite has entered into a particular bottle. Let those who affirm the exception to the general law of nature, or those others who upon the affirmation accept the result, work out the experimental proof. It has been done in this case by Schulze, and is in the negative; but how few among the many who make, or repeat, the assertion, would have the requisite self-abnegation, the subjected judgment, the perseverance, and the precision which has been displayed in that research.

When men, more or less marked by their advance, are led by circumstances to give an opinion adverse to any popular notion, or to the assertions of any sanguine inventor, nothing is more usual than the attempt to neutralize the force of such an opinion by reference to the mistakes which like educated men have made; and their occasional misjudgments and erroneous conclusions are quoted, as if they were less competent than others to give an opinion, being even disabled from judging like matters to those which are included in their pursuits by the very exercise of their minds upon them. How frequently has the reported judgment of Davy, upon the impossibility of gas-lighting on a large scale, been quoted by speculators engaged in tempting monied men into companies, or in the pages of journals occupied with the popular fancies of the day; as if an argument were derivable from that in favour of some special object to be commended. Why should not men taught in the matter of judgment far beyond their neighbours, be expected to err sometimes, since the very education in which they are advanced can only terminate with their lives? What is there about them, derived from *this education*, which sets up the shadow of a pretence to

perfection? Such men cannot learn all things, and may often be ignorant. The very progress which science makes amongst them as a body is a continual correction of ignorance—*i.e.* of a state which is ignorance in relation to the future, though wisdom and knowledge in relation to the past. In 1823, Wollaston discovered that beautiful substance which he called Titanium, believing it to be a simple metal: and it was so accepted by all philosophers. Yet this was a mistake, for Wöhler, in 1850, showed the substance was a very compound body. This is no reproach to Wollaston or to those who trusted in him; he made a step in metallurgy which advanced knowledge, and perhaps we may hereafter, through it, learn to know that metals are compound bodies. Who, then, has a right to quote his mistake as a reproach against him? Who could correct him but men intellectually educated as he himself was? Who does not feel that the investigation remains a bright gem in the circlet that memory offers to his honour?

If we are to estimate the utility of an educated judgment, do not let us hear merely of the errors of scientific men, which have been corrected by others taught in the same careful school; but let us see what, as a body, they have produced, compared with that supplied by their reproachers. Where are the established truths and triumphs of ring-swingers, table-turners, table-speakers? What one result in the numerous divisions of science or its applications can be traced to their exertions? Where is the investigation completed, so that, as in gas-lighting, all may admit that the principles are established and a good end obtained, without the shadow of a doubt?

If we look to electricity, it, in the hands of the careful investigator, has advanced to the most extraordinary results: it approaches at the motion of his hand; bursts from the metal; descends from the atmosphere; surrounds the globe: it talks, it writes, it records, it appears to him (cautious as he has learned to become) as a universal spirit in nature. If we look to photography, whose origin is of our own day, and see what it has become in the hands of its discoverers and their successors, how wonderful are the results! The light is made to yield impressions upon the dead silver or the coarse paper, beautiful as those it produced upon the living and sentient retina: its most transient impression is rendered durable for years; it is made to leave a visible or an invisible trace; to give a result to be seen now or a year hence; made to paint all natural forms and even colours; it serves the offices of war, of peace, of art, science, and economy: it replaces even the mind of the human being in some of its lower services; for a little camphine lamp is set down and left to itself, tc perform the duty of watching the changes of magnetism heat, and other forces of nature, and to record the results, in pictorial curves, which supply an enduring record of their most transitory actions.

What has clairvoyance, or mesmerism, or table-rapping done in comparison with results like these? What have the snails at Paris told us from the snails at New York? What have any of these intelligences done in *aiding* such developments? Why did they not inform us of the possibility of photography; or, when that became known, why did they not favour us with some instructions for its improvement? They all profess to deal with agencies far more exalted in character than an

electric current or a ray of light: they also deal with mechanical forces; they employ both the bodily organs and the mental: they profess to lift a table, to turn a hat, to see into a box, or into the next room, or a town: —why should they not move a balance, and so give us the element of a new mechanical power? take cognizance of a bottle and its contents, and tell us how they will act upon those of a neighbouring bottle? either see or feel into a crystal, and inform us of what it is composed? Why have they not added one metal to the fifty known to mankind, or one planet to the number daily increasing under the observant eye of the astronomer? Why have they not corrected one of the *mistakes* of the philosophers? There are no doubt very many that require it. There has been plenty of time for the development and maturation of some of the numerous public pretences that have risen up in connexion with these supposed agencies; how is it that not one new power has been added to the means of investigation employed by the philosophers, or one valuable utilitarian application presented to society?

In conclusion, I will freely acknowledge that all I have said regarding the great want of judgment manifested by society as a body, and the high value of any means which would tend to supply the deficiency, have been developed and declared on numerous occasions, by authority far above any I possess. The deficiency is known hypothetically, but I doubt if in reality; the individual acknowledges the state in respect of others, but is unconscious of it in regard to himself. As to the world at large, the condition is accepted as a necessary fact; and so it is left untouched, almost ignored. I think that education in a large sense should be applied

to this state of the subject, and that society, though it can do little in the way of communicated experience, can do much, by a declaration of the evil that exists and of its remediable character; by keeping alive a sense of the deficiency to be supplied; and by directing the minds of men to the practice and enlargement of that self-education which every one pursues more or less, but which, under conviction and method, would produce a tenfold amount of good. I know that the multitude will always be behindhand in this education, and to a far greater extent than in respect of the education which is founded on book learning. Whatever advance books make, they retain; but each new being comes on to the stage of life, with the same average amount of conceit, desires, and passions, as his predecessors, and in respect of self-education has all to learn. Does the circumstance that we can do little more than proclaim the necessity of instruction justify the ignorance? or our silence? or make the plea for this education less strong? Should it not, on the contrary, gain its strength from the fact that all are wanting more or less? I desire we should admit that, as a body, we are universally deficient in judgment. I do not mean that we are utterly ignorant, but that we have advanced only a little way in the requisite education, compared with what is within our power.

If the necessity of the education of the judgment were a familiar and habitual idea with the public, it would often afford a sufficient answer to the statement of an ill-informed or incompetent person; if quoted to recall to his remembrance the necessity of a mind instructed in a matter, and accustomed to balance evidence, it might frequently be in answer to the individual himself.

Adverse influence might, and would, arise from the careless, the confident, the presumptuous, the hasty, and the dilatory man, perhaps extreme opposition; but I believe that the mere acknowledgment and proclamation of the ignorance, by society at large, would, through its moral influence, destroy the opposition, and be a great means to the attainment of the good end desired: for if no more be done than to lead such to turn their thoughts inwards, a step in education is gained: if they are *convinced* in any degree, an important advance is made; if they learn only to *suspend* their judgment, the improvement will be one above price.

It is an extraordinary thing that man, with a mind so wonderful that there is nothing to compare with it elsewhere in the known creation, should leave it to run wild in respect of its highest elements and qualities. He has a power of comparison and judgment, by which his final resolves, and all those acts of his material system which distinguish him from the brutes, are guided: shall he omit to educate and improve them when education can do much? Is it towards the very principles and privileges that distinguish him above other creatures, he should feel indifference? Because the education is internal, it is not the less needful; nor is it more the duty of a man that he should cause his child to be taught than that he should teach himself. Indolence may tempt him to neglect the self-examination and experience which form his school, and weariness may induce the evasion of the necessary practices; but surely a thought of the prize should suffice to stimulate him to the requisite exertion: and to those who reflect upon the many hours and days, devoted by a lover of sweet sounds, to gain a moderate facility upon a mere me-

chanical instrument, it ought to bring a correcting blush of shame, if they feel convicted of neglecting the beautiful living instrument, wherein play all the powers of the mind.

I will conclude this subject;—believe me when I say I have been speaking from self-conviction. I did not think this an occasion on which I ought to seek for flattering words regarding our common nature; if so, I should have felt unfaithful to the trust I had taken up; so I have spoken from experience. In thought I hear the voice, which judges me by the precepts I have uttered. I know that I fail frequently in that very exercise of judgment to which I call others; and have abundant reason to believe that much more frequently I stand manifest to those around me as one who errs, without being corrected by knowing it. I would willingly have evaded appearing before you on this subject, for I shall probably do but little good, and may well think it was an error of judgment to consent: having consented, my thoughts would flow back amongst the events and reflections of my past life, until I found nothing present itself but an open declaration, almost a confession, as the means of performing the duty due to the subject and to you.

EVIDENCE OF DR. M. FARADAY.

Q. Will you have the goodness to give us your opinion, as the result of your observation and experience, upon the state of knowledge of the physical sciences and natural history in this country, with reference to our educational system? - *A.* I can give you my impression, as far as that is permissible, independent of any co parison between that part of knowledge and other branches. I am not an educated man, according to the usual phraseology, and therefore can make no comparison between languages and natural knowledge, except as regards the utility of language in conveying thoughts; but that the natural knowledge which has been given to the world in such abundance during the last fifty years should remain, I may say, untouched, and that no sufficient attempt should be made to convey it to the young mind, growing up and obtaining its first views of these things, is to me a matter so strange that I find it difficult to understand it. Though I think I see the opposition breaking away, it is yet a very hard one to overcome. That it ought to be overcome, I have not the least doubt in, the world....

Q. You probably are aware that what our great schools profess and aim at most, is to give a good training to the mind; and it is there considered, perhaps, as you were saying just now, from habit and from prestige, that that is effectually done by the study of the classics and of pure mathematics, and that in that way they furnish the best training of the mind that can be given. Now, I would ask you, whether you think, supposing the training of the mind is the object in the public schools, that that system of training the mind is complete which excludes physical science? whether the study of physical science would call into activity faculties of the mind that are not so developed by studies confined to classics and mathematics? - *A.* The phrase, "training of the mind," has to me a very indefinite meaning. I would like a profound scholar to indicate to me what he means by "training of the mind;" in a literary sense, including mathematics. What is their effect on the mind? What is the kind of result that is called the "training of the mind"? Or what does the mind learn by that training? It learns things, I have no doubt. Hy the very act of study, it learns to be attentive, to be pcnevering, to be lojtical, according to the word "logic." But d o a

it learn that training of the mind which enables a man to give a reason, in natural things, for an effect which happens from certain causes; or why, in any emergency or event, he does, or should do, this, that, or the other? It does not suggest the least thing in these matters. It is the highly educated man that we find coming to us, again and again, and asking the most simple questions in chemistry and mechanics; and when we speak of such things as the conservation of force, the permanency of matter, and the unchangeability of the laws of nature, they are far from comprehending them, though they have relation to us in every action of our lives. Many of these instructed persons are as far from having the power of judging of these things as if their minds had never been trained.

Q. You would not consider that the minds of such men as you allude to, who have been highly trained, and who have great literary proficiency, are in a state readily to receive such information as they are deficient in?—*A.* I find them greatly deficient; not in their own studies, or in their applications of them, but when taken out of that into natural sciences. Ask what is the reason of this or that,—they have a difficulty in giving the reason. If they are called upon to judge in a case of natural science, they find it difficult to give a judgment; they have not studied it.

Q. You do not find any particular aptitude in those minds for grasping a new subject?—*A.* I do not. Take those minds, and apply them to the special subjects which they have never touched upon or known of, and they have to go to the beginning, just as the juvenile does. They are no more ready. The young mind, as I find it, formed by habits, forced this way and that way, is very observant, and asks most acute questions. I do not find that mind, generally speaking, backward in understanding the statement I make to him in simple language; and if I tell him this or that,—if I tell him that the atmosphere is compounded of oxygen, nitrogen, and so on, and then shape it into a question,—he can generally answer me. I must confess to you, that I find the grown-up minds coming back to me with the same questions over and over again. They ask, What is water composed of? though I have told the same persons, a dozen years in succession, that it is composed of oxygen and hydrogen. Their minds are not prepared to receive or to embody these notions; and that is where you want education,—to teach them the A B C of these things.

Q. You think that exclusive attention to one set of studies during early life rather precludes the ready adoption of these ideas?—*A.* Yes. It does not blunt the mind—I do not think it does—but it so far gives the growing mind a certain habit, a certain desire and willingness to accept general ideas of a literary kind, and to say all the rest is nonsense, and belongs to the artisan, that it is not prepared to accept, and does not accept, the other and greater knowledge.

Q. So that the mind runs in a particular groove, from which it

does not extract itself easily?—*A.* Yes: by that degree of habit, the mind, I do think, is really injured for the reception of other knowledge. . . . *Q.* Supposing the one main object of education to be to train the mind to ascertain the sequence of a particular conclusion from certain premises; to detect a fallacy; to correct undue generalization; or generally to prevent the growth of mistakes in reasoning,—should you consider physical science is as valuable for that object as classical instruction is?—*A.* I do not see clearly how classical studies do educate the mind for that kind of judgment; but, as regards the exercise of the judgment on the laws of matter, it is to me the most fertile source of the exercise of that judgment, and the true logic of facts, which I can conceive of, and which enables the man, when he has the facts in his hand, to apply them in every form and shape. . . . I think I see a most lamentable deficiency, even in the highly educated men, of that kind of logic. . . . I hope I shall offend nobody if I try to illustrate my feeling in that respect. Up to this very day, there come to me persons of good education, men and women, quite fit for all that you expect from education: they come to me, and they talk to me about things that belong to natural science; about mesmerism, table-turning, flying through the air; about the laws of gravity: they come to me to ask me questions; and they insist against me, who think I know a little of these laws, that I am wrong and they are right, in a manner which shows how little the ordinary course of education has taught such minds. Let them study natural things, and they will get a very different idea from that which they have obtained from that education. It happens up to this day. I do not wonder at those who have not been educated at all; but such as I refer to, say to me, "I have felt it, and done it, and seen it; and, though I have not flown through the air, I believe it." Persons who have been fully educated, according to the present system, come with the same propositions as the untaught and stronger ones, because they have a stronger conviction that they are right. They are ignorant of their ignorance at the end of all that education. It happens even with men who are excellent mathematicians. They and you will say, "But you are most likely wrong, and they right." It may be so; at all events, the education we speak of in natural things, will be something in addition to that which they gain by their study of the classics. Until they know what are the laws of nature, and until they are taught by education to see what are the natural facts, they cannot clear their minds of these, as I say, most absurd inconsistencies; and I say again, as I said once before, that the system of education that could leave the mental condition of the public body in the state in which this subject has found it, must have been greatly deficient in some very important principle.

Q. When you say that you have not been able to understand in what way classical instruction trains the mind, you are aware that many, perhaps most, of the defenders of classical education defend it on the ground, not that it teaches certain things, nor that the

classics, as classics, have any peculiar value ; but that, through the classics, both the laws of language and the structure of language are studied; and that it is the study of the laws of language which is held best to develop and strengthen the mental faculties ?-*A*. That is narrowing the question this way, that, in place of saying you are taking the classics, you take the laws of language; and no doubt they give that education, as far as I can see. I am reasoning in the dark, because I have not had the opportunity, and have not the right, to speak of these things. I confess all that ; but althm.gh :t be a very important thing to know language perfectly, and to know :ts laws, or to carry it out, as the most profound scholar would do, oy tracing all languages to an original one, or what not,-Max Miiller or anybody else,-that is not all knowledge. I am not attacking the classics at all. I am only putting in a plea for that other knowledge which belongs to our absolute nature, and, in fact, which language only helps to describe.

Q What is held, I believe, by the defenders of classical literature is, that the study of language strengthens the general powers of the mind in its application to any other subjects whatever which m;ty come before it, and that in that way the mind is best strengthened as an instrument for acquiring any other kind of knowledge whatever ?-*A*. I sec the value of those studies which do lead to such a result ; but I think that, at present, society at large is almost i$_{g\ n}$orant of the like and greater value of the kind of studies which I recommend.... I say, that these physical sciences, in my opinion, ought to be brought forward also ; and I say it the more boldly, because the learned men who have been so educated in languages do not show any aptness to judge of physical science, In matters of natural knowledge, and all the uses and applications derived from it, I should tum to a man, untaught in other respects, who I knew wa!i acquainted with these subjects, rather than to a classical scholar, as expecting to find within his range that mode of mind, or that management of the mind, which would enable him to speak with understanding. Any word that I have said that has led you to think that I am opposed to classics, I must withdraw, I have no such feeling.